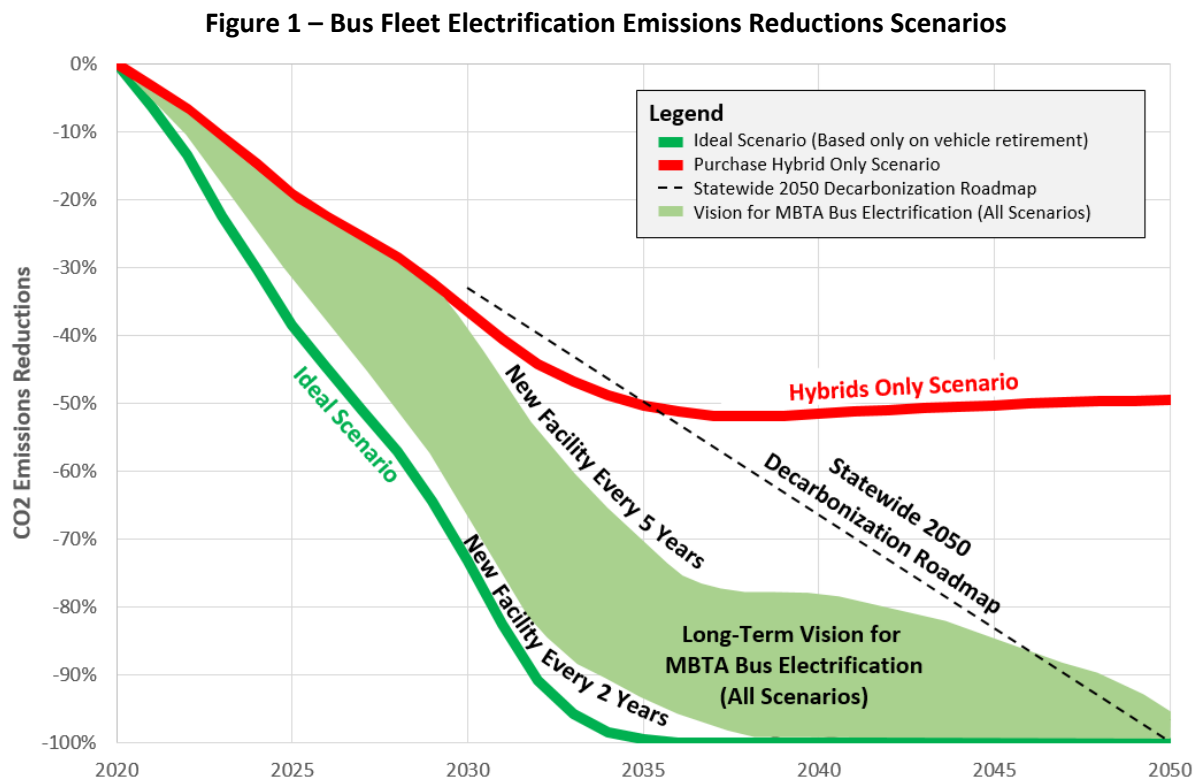


Bus Fleet Electrification: Emissions Reductions Potential

The MBTA is working on a phased approach to transition to BEBs over the next several decades. BEBs will help reduce the MBTA's carbon footprint and contribute to the plans outlined in the Massachusetts 2050 Decarbonization Roadmap with calls for net zero emissions across the Commonwealth by 2050. These targets include emissions from all sources - transportation, buildings, electricity generation, and others. However, they provide a helpful framework with which to compare our progress.

Given this context, the MBTA is charting a path to meet the Commonwealth's goals through our fleet and facility plans. In support of this work, the MBTA completed a fleet emissions analysis for our bus electrification efforts shown in figure 1.



Through this analysis, the MBTA is able to conclude:

1. **Vision** - Our electrification efforts provide a long-term vision which robustly reduces bus fleet emissions while staying ahead of statewide emissions targets in most scenarios.
2. **Facilities** - The rate at which the MBTA can fund, design, and construct facility capacity to support BEBs acts as the largest bottleneck to the MBTA's bus electrification plan.
3. **Technology** - Technology readiness is less critical than originally hypothesized. If BEB technology is ready to support the MBTA's requirements by 2030, facility BEB capacity will continue to be the bottleneck of BEB adoption

This vision to meet the Commonwealth's decarbonization plan does not come without risk. As Figure 1 shows, there are limited scenarios in which the MBTA could fall behind the Commonwealth's target. Facility upgrades to support BEBs represent the largest risk to our vision. In order to meet the 2050 zero fleet emissions target, the MBTA will need to ensure facilities are not a bottleneck to BEB adoption beyond 2035. Additionally, the MBTA will seek out technology opportunities which help enhance our vision over the decades to come.

A Closer Look at the Fleet Emissions Analysis

Taking a closer look at figure 1 helps us understand how we came to the conclusion the MBTA is on track to robustly meet the state's emissions plan. Figure 1 illustrates the following scenarios:

Unconstrained Scenario - This scenario illustrates the limit on how fast the MBTA can electrify our fleet without breaking FTA guidelines for useful vehicle life. When a bus reaches the end of its useful life in this scenario, it is replaced by a battery electric bus. This scenario does not take into account the facilities' capacity to support BEBs or technology readiness.

Business as Usual – This scenario represents the resulting emissions if the MBTA would buy hybrid buses indefinitely. While we are not planning for this scenario, this does illustrate the worst case for fleet emissions for the MBTA. Providing a useful comparison.

Vision for Bus Electrification – This analysis spans scenarios that vary facility build rate and battery technology readiness. The resulting shaded area illustrates the range of emissions outcomes if new BEB facilities are built every 3-5 years and battery technology is ready by 2025.

State Average Emissions Target – Represents the statewide emissions targets laid out in the Massachusetts 2050 Decarbonization Roadmap. The MBTA bus fleet currently makes up 0.1% of statewide emissions. While the MBTA is not explicated given a target in the state roadmap, the MBTA will demonstrate leadership in reducing our carbon emissions by outpacing the statewide guidelines. Please note, the emissions guidelines on figure 1 have been translated from a 1990 baseline to a 2020 baseline. These guidelines reflect the reduction in 1990 emissions levels with a target a 45% reduction by 2030 and net zero emissions by 2050.

The model was built to provide a high-level view of how bus technology and facility upgrades will affect fleet emissions. This was achieved through an input of projected build dates/sites and bus capacities of our bus facilities as well as fuel consumption for each vehicle configuration. The model projects the number of BEBs adopted each year by checking the available facility capacity to support BEBs at the time a bus is scheduled to be retired according to the state of good repair. Vehicle miles travel (VMT) was held constant to illustrate the MBTA's ability to electrify our fleet independent of changes in ridership demand. Future studies could be completed to understand how ridership changes affect our emissions.